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State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

ROSICLARE AREA

Hardin County

Golconda, Cave in Rock, Shawneetown, and Equality Quadrangles

Leaders
George M. Wilson and I. Edgar Odom
Urbana, Illinois
April 12, 1958

 HOST: Rosiclare High School

ROSICLARE GEOLOGICAL SCIENCE FIELD TRIP

Itinerary

0.0 0.0 Caravan assembles in front of the Rosiclare High School, heading west.

Historical Notes on Fluorspar Development

Rosiclare is the fluorspar capital of the United States, and a large part of the fluorspar used in American industry comes from the Rosiclare and Cave in Rock district. Fluorspar (the mineral name is fluorite) is a hard, glassy mineral composed of two chemical elements, calcium and fluorine. It is commonly gray or yellowish white, but is sometimes white, blue, green, or black. Some varieties glow in invisible ultraviolet light; this property is named "fluorescence," after the mineral.

More than 50 percent of the fluorspar produced in Illinois is used for the manufacture of hydrofluoric acid. Largest consumer of the acid is the aluminum industry. Hydrofluoric acid also enters into the preparation of many fluorine chemicals, including those which play a part in the manufacture of refrigerants, plastics, insecticides, aerosols, and high energy fuels for rockets and missiles. A large amount of fluorspar is used as a flux in the iron and steel industry and in the ceramic industry for making glass and enamels.

Illinois produces over half of the nation's "finished" fluorspar--that is, fluorspar of high purity that has been separated from crude ore by cleaning and concentrating processes. Most of the fluorspar mined in the United States comes from a small area in Illinois and Kentucky. Illinois produces the larger share, 134,529 tons in 1960 valued at $6,935,500.

The Rosiclare district has had a long and varied mining history. Prior to the coming of the white man, Indians or prehistoric peoples carved ornaments and images from colorless fluorspar. Because of its beautiful colors, well crystallized fluorite is still highly sought for the carving of small ornamental objects.

The first known mining operation in this region began in 1842 after the discovery of a fluorspar and galena deposit by William Pell on his farm about one half mile northwest of Rosiclare. Galena, the ore of lead, was the principal mineral sought and recovered. Between 1842 and 1870, the deposits in the Rosiclare district were worked for their lead content. The spar mined with the galena was largely discarded as waste, for it had only a limited market.

Shipments of fluorspar from mines in the district apparently began in the early 70's. The demand steadily increased between 1870 and 1910. During this 40-year period, the Fairview Fluorspar and Lead Company, The Rosiclare Lead Company, and the Rosiclare Fluorspar and Lead Company were the chief producers. The Fairview holdings were sold to the Franklin Fluorspar Company, a subsidiary of Alcoa, in 1924.

About 1910, the Rosiclare and Fairview companies increased the capacity of their mills to 400 tons per day. This might be considered

to mark the beginning of the modern era of large-scale production in the Rosiclare district. World War I greatly increased the demand for spar, stimulating exploitation of existing deposits and the search for new ones. In 1919 the Illinois Central Railroad was extended from Golconda to Rosiclare, permitting the shipment of fluorspar by rail. Prior to that time all shipments were made by barge on the Ohio River.

In 1924, the Rosiclare district suffered a great setback. Almost all of the mines along the Fairview-Rosiclare vein were flooded by water probably coming from the Ohio River. The Rosiclare mines remained flooded until 1940 when they were drained. Water is still a major problem, however, even with the large pumps now employed.

During the 16-year interval while the Rosiclare-Fairview mines were flooded, the Daisy and Hillside mines north of Rosiclare supplied most of the spar to maintain the large mill of the Rosiclare Lead and Fluorspar Company. Most of the spar milled by Alcoa during this interval came from their mines in Kentucky.

Since 1940 the demand for fluorspar has remained fairly high. In recent years fluorspar produced for making aluminum, fluorine compounds, and ceramic products, in addition to that sold for making steel has been an important factor in the growth of the industry.

0.1 0.1 STOP. Turn left. Note the buildings of the Rosiclare Lead and Fluorspar Mining Company on right.

0.3 0.4 Slow. Turn right.

0.1 0.5 Note the alignment of the shafts in the region. The shafts indicate the trend of a mineralized fault zone.

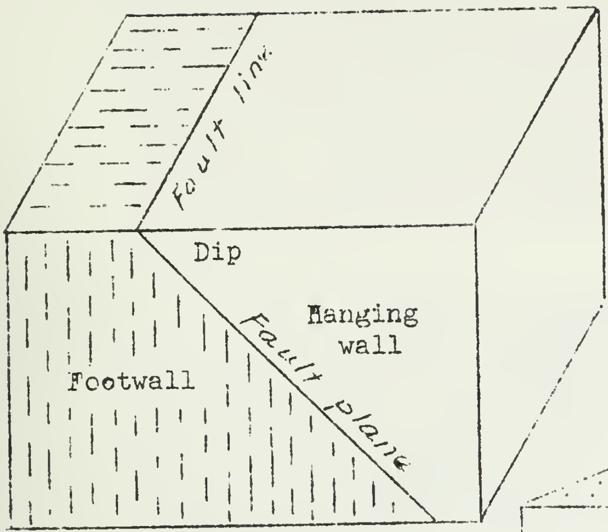
0.2 0.7 Slow. Turn left. Stop 1. Discussion of Mineralized Fault Zones.

Here we see a mineralized fault zone. This is a subsidiary fault of the major Rosiclare Fault which lies a short distance to the east. The Rosiclare Fault is heavily mineralized and is the most productive in the region. This fault, as do most of the other faults in this region, trends NE-SW.

Most of the faults in the Rosiclare District are not simple fractures, but consist of a series of closely spaced fractures, commonly referred to as a fault zone. We will discuss fault zones more fully at Stop 4. The major faults are roughly parallel, but underground workings show that they follow undulatory courses and locally change direction sharply for short distances.

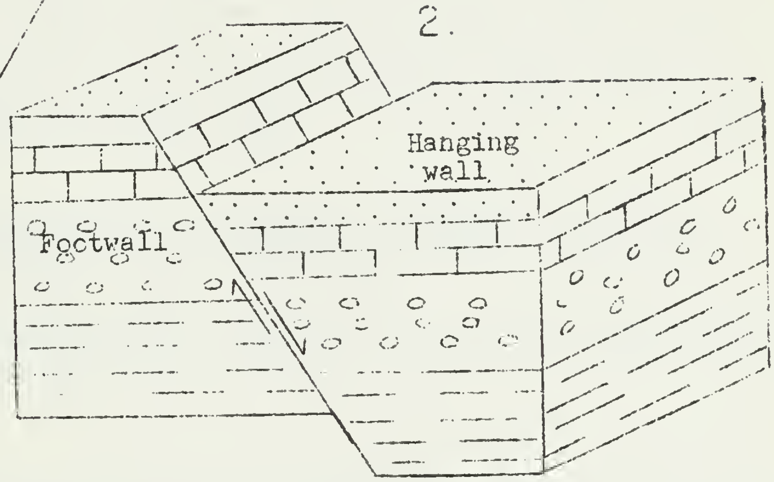
Slickensides, common along the fault planes, indicate that some movement has taken place. In the Rosiclare District the west side of most of the faults has moved down in relationship to the east side, and the plane of the faults dips to the west. Along the fault we see at this stop, the Cypress Sandstone on the west side is in contact with the Renault Limestone on the east, indicating the west side has moved down with respect to the east side. This type of fault is called a normal fault (fig. 2, page 3).

1



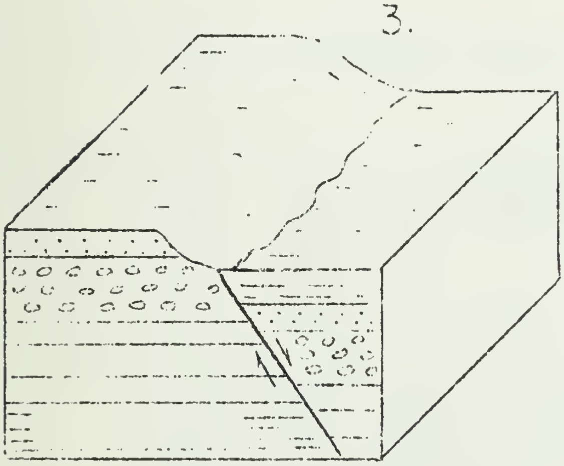
Terminology for a fault plane

2.



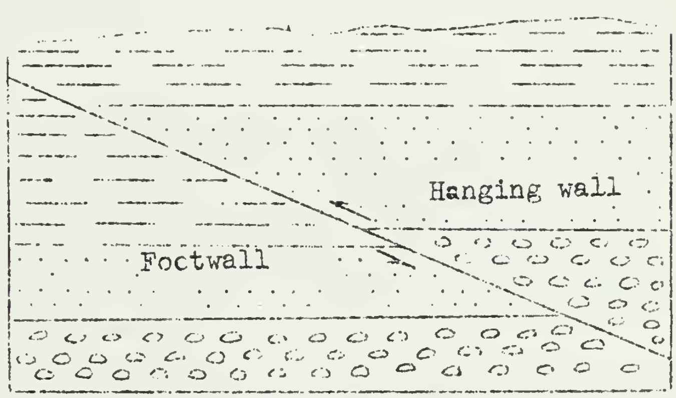
Normal or gravity fault

3.



Fault line scarp

4



Thrust fault

The fluorspar bearing veins of the Rosiclare District occur along faults. Accompanying the fluorite in large quantities is the mineral calcite. Other minerals that commonly occur in small amounts are quartz, spahlerite, galena, pyrite, chalcopyrite and barite. Mineralization along the faults apparently occurred from ascending solutions as fissure fillings. At places where open fissures were not present, the mineralization pinches out but the faults continue. Incompetent shale beds played a leading role in causing pinch-outs and the blocking of ascending solutions. The mineralization in the Cave in Rock District differs from the Rosiclare District in that it occurs as blanket deposits adjacent to fault zones rather than along them. We will discuss this type of mineralization at Stop 8.

The common method of mining the vein deposits in the Rosiclare District is to drive a shaft down vertically along the fault. Levels are then extended horizontally at vertical intervals of 100 feet. The veins are mined upward from one level to the other by the stoping method. Some mines are as much as 800 feet deep. The subsidiary fault at this stop has been stripmined to a depth of about 35 feet. This type of mining is applicable where the spar outcrops, but is limited by depth of weathering to depths of less than 50 feet.

0.2	0.9	Slow, turn hard left. Note the Alcoa concentration plant on right. This plant produces fluorspar for the making of aluminum. Note the discharge water from the Alcoa mines on the left.
0.2	1.1	Seismograph surveys conducted in this valley indicate that several igneous dikes occur beneath the overburden.
0.2	1.3	STOP. Turn left.
0.5	1.8	Caution. Railroad crossing. Note the concentration plant of the Ozark-Mahoning Company on the far right.
0.6	2.4	Note the shafts on the right. These shafts are located on two parallel faults. The shaft nearest the highway is the Daisy shaft on the Daisy Fault. The other is the Hillside shaft on the Hillside Fault. Neither mine is being worked at the present time.
0.3	3.7	STOP. Turn right on Route 146.
0.4	4.1	Note the new pump house and tipple on the left. Some of the abandoned mines in this area are about to be reopened. When these mines were being worked, economic conditions did not permit the complete scaling of the spar from the walls of the veins or the exploring of small mineralized off-shoots from the main vein. Now that the price of spar is much higher, it is economically feasible to re-enter these mines and recover the spar left behind during earlier operations.
1.1	5.2	Outcrop of St. Louis Limestone on right and left. Note the pinkish cast on the joints cutting the limestone. This coloring is due to the presence of fluorspar along the joints.
0.3	5.5	Bridge across Big Bay Creek.
0.1	5.6	Outcrop of St. Louis Limestone on left.

0.4 6.0 Entering Elizabethtown. The business part of Elizabethtown is located on a terrace. This quaint old town, beautifully situated overlooking the Ohio River, is the county seat of Hardin County. It was established between 1805 and 1807. Some of the descendents of the early inhabitants still live in the town and in the country nearby. In 1808 James McFarland built the Rose Hotel which is still in operation today. The town is named for McFarland's wife, Elizabeth.

0.2 6.2 STOP. Continue ahead. View of Ohio River on the right.

0.4 6.6 Note the sinkholes in the St. Louis Limestone on the right.

0.4 7.0 Note numerous sinkholes in the St. Louis Limestone on the right.

0.4 7.4 Stop 2. Outcrop of St. Louis Limestone.

Overlying the St. Louis Limestone we see about 15 feet of red chert, limestone, and clay residuum. This is, in turn, overlain by about seven feet of dark brown loess. The red residual material was produced by the weathering processes from the underlying limestone. The brown loess was spread over this region from the Ohio River valley during the Pleistocene, or Ice Age.

Prior to the Ice Age the red material was a residual soil. A deep residual soil such as this indicates that this region was subject to the soil forming processes for a long period of time without much erosion, or that soil formation was going on at a rapid rate before the loess was deposited. You will note that the red residual material reflects the composition of the parent rock from which it was derived.

Another interesting feature present at this stop is the many veinlets of calcite which cut the limestone bedrock. If you look closely at some of the joint faces, you will also find traces of fluorspar.

0.1 7.5 Outcrop of St. Louis Limestone. The beds dip to the northeast.

0.1 7.6 Outcrop of St. Louis Limestone. Note the cross-bedding in the limestone, probably indicating that this limestone was deposited in relatively shallow water.

1.2 8.8 Note the high northeasterly trending hill on the left. A fault passes NE-SW along the face of it. The hill is on the up-thrown side of the fault and is termed a fault line scarp (fig. 3).

0.2 9.0 Outcrop of St. Louis Limestone.

0.8 9.8 The Peters Creek Fault Zone parallels the high hill on the left. This is the same hill we saw on the left one mile down the highway. The Peters Creek Fault Zone is one of the principle structural features in Hardin County.

1.2 11.0 Stop 3. East side of Peters Creek.

Here we can observe some of the effects of faulting in what were flat lying sedimentary rocks. Sandstone beds of the Bethel Formation are steeply inclined to the west and are heavily jointed. The sandstone is underlain by shale and limestone of the Renault Formation.

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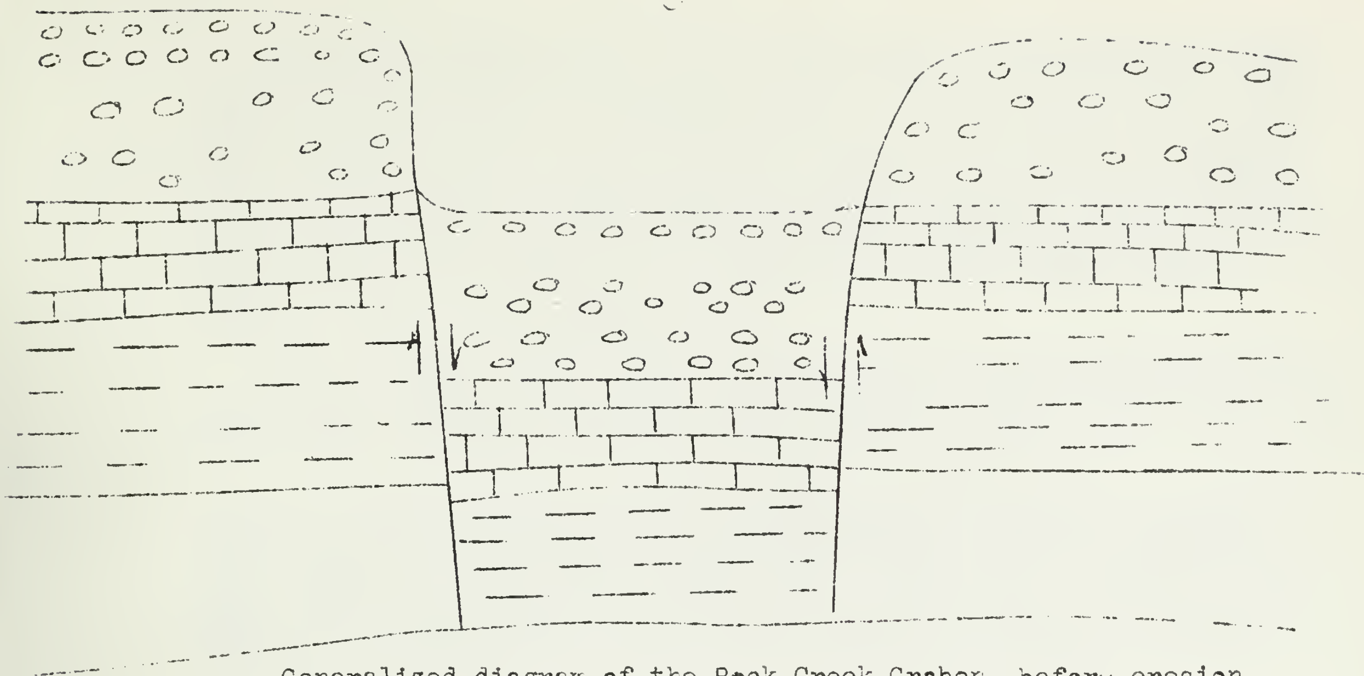
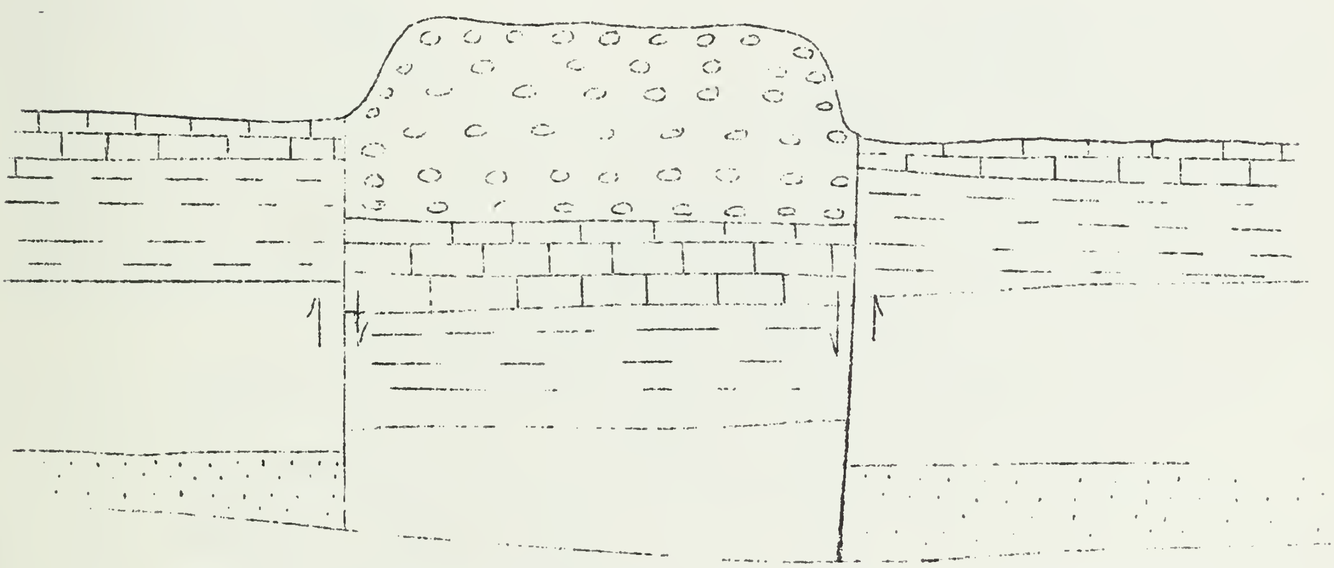


Generalized diagram of the Rock Creek Graben, before erosion

6



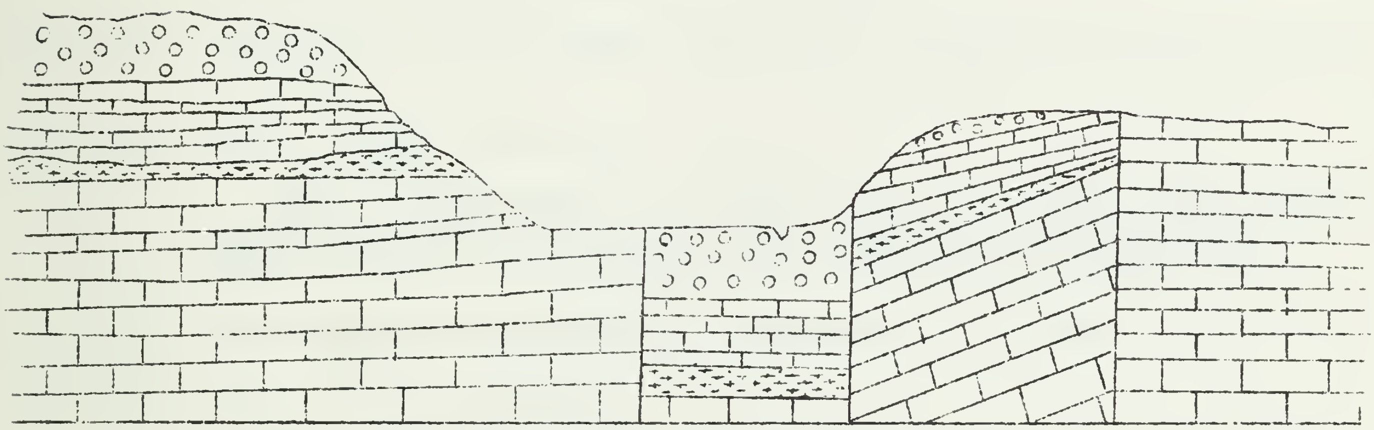
Generalized diagram of the Rock Creek Graben, after erosion

There are at least three, and possibly more, NE-SW trending faults which cut the rocks in the immediate area. One is located west of the creek, with the other two occurring on the east side of the creek, one passing just a few yards west of the outcrop and the other a few yards east. The faulting has produced a structural feature called a graben. A graben consists of a down-thrown block bounded on the sides by high-angle faults. The conditions are much like those illustrated in figure 6, except that there are at least three major faults involved instead of two as the diagram shows.

The structural relationships across the Peters Creek Fault Zone at this location are not well known. The following diagram shows the general ups and downs along an east-west line at this location.

It was stated before that the faults in this area are not simple fractures but are characterized by more or less intensely shattered zones composed of intimately related fault planes which branch and converge both horizontally and vertically in a complex and unpredictable manner. The Peters Creek Fault Zone is about as complex as we find in Hardin County.

The mineralization in the Cave in Rock area is strongly related to the Peters Creek Fault Zone. It differs from that in the Rosiclare area in that it occurs adjacent to the faults as bedded blanket deposits rather than along the faults as veins.



East-West Section Along Peters Creek

0.8 11.8 Lower St. Louis Limestone outcrops on right and left.

0.3 12.1 Note primitive mining on the hill on the far left.

0.5 12.6 Sinkholes on right and left.

1.0 13.6 Stop 4. Discussion of Cuestas.

In areas where folding, tilting, or faulting has occured in flat lying sedimentary rocks, long narrow ridges develop after considerable erosion. If they are unsymmetrical, these are called cuestas.

Slower eroding resistant rock layers are responsible for cuesta development. These resistant rock layers are always found capping the cuestas.

The steep south slope is called the cuesta face and is an erosional escarpment formed in the Fredonia Limestone. The gentle back slope parallels the dip or inclination of the resistant Rosiclare Sandstone which caps the cuesta.

0.2 13.8 Note the extremely large water-filled sinkhole on the left. This large lake may be present for some time, but periodically it suddenly disappears as its water escapes underground. When this underground drain becomes plugged with sediment and debris, the lake again comes into being.

0.5 14.3 Note the irregular weathering of the limestone in the sinkhole on the left.

1.0 15.3 STOP. Turn right on Highway 1.

1.5 16.8 Entering Cave in Rock.

0.4 17.2 Slow. Turn left.

0.1 17.3 Slow. Turn right, then left.

0.1 17.4 Entering Cave in Rock State Park. Continue ahead to top of hill and park in the parking lot at the shelter house.

0.3 17.7 Note the park superintendent's home on the left which is built of native sandstone.

0.3 18.0 Stop 5. LUNCH. Let's eat!

The park superintendent has done a great deal of extra work getting ready for our visit. Let's show that we appreciate it by making sure that no refuse is left around. We will visit the cave after lunch.

0.0 18.0 Turn cars around in parking lot and proceed down the hill.

0.6 18.6 Stop 6. Cave in Rock Cave.

Leave your hammer in the car. We must preserve the natural beauty of the cave for future visitors. Considerable damage has already been done by those who insist upon leaving their unwanted marks.

Take the trail along the river bluff to the cave. Note the direction of the numerous joints and the many white and blue chert nodules.

The cave is an excellent example of how underground water moving along joints dissolves away limestone to produce caverns. Most of the water which formed this cave entered through the sinkhole in the roof at a time when the land had a different configuration than it has today. No cave deposits formed in this cave, probably because of its proximity to the surface. The cave also illustrates the control an incised stream has upon cavern development in limestone regions.

Note the many parallel chert bands on the walls of the cave. These stand out because chert is much harder and more resistant than limestone. Chert is abundant in the St. Louis Formation throughout the Illinois Basin, and adjacent areas.

0.1 18.7 Slow. Turn right and left.

0.2 18.9 STOP. Turn right.

1.9 20.8 Stop 7. Okerson Quarry.

This quarry is the Fredonia member of the Ste. Genevieve Formation. In this region the Ste. Genevieve Formation is divided into three members: the Levias Limestone at the top, the Rosiclare Sandstone in the middle, and the Fredonia Limestone at the base. The Rosiclare Sandstone occurs at the top of the hill, but it cannot be seen from the quarry. The Rosiclare is the cuesta-forming sandstone which we discussed at Stop 4 and the quarry is located in the face of the large cuesta we observed there.

This quarry also offers us an opportunity to study in outcrop one of the major oil producing formations in the Illinois Basin. The operators informed us that on occasions small pockets of oil are found in the limestone. It is possible that this limestone was once saturated, but that the oil migrated northward when the rocks were tilted in that direction.

0.3 21.1 The Rosiclare Sandstone outcrops on the left.

0.7 21.8 Note the gentle downward inclination of the highway. The road follows the back slope of a cuesta.

1.3 23.1 Note the fluorspar mines of the Ozark-Mahoning Company on the left.

0.1 23.2 Note the slump structures in upper Chester Sandstone and Shale. The slumping is due to solution of an underlying limestone bed.

0.3 23.5 Slow, turn left. Note tipple of spar mine on hill ahead.

0.3 23.8 Note cavern development in the bluff on the right.

0.6 24.4 Water-filled sinkholes on left and right.

0.4 24.8 View of Ozark-Mahoning mines on the left.

0.4 25.2 Note the fault scarp on the right. The escarpment consists of lower Pennsylvanian sandstones which have been faulted down. The Peters Creek Fault zone passes along the front of the escarpment.

This escarpment is the southern boundary of the Rock Creek Graben which extends southwest from the northeastern corner of Hardin County, crosses the Ohio River between Rosiclare and Shetlerville, traverses the western part of Livingstone County, Kentucky, and re-enters Illinois west of Bay City in Pope County, beyond which it is concealed beneath Cretaceous strata. The fault systems which bound this graben are complex. A north-bounding fault, termed the Illinois Furnace Fault, north of

Rosiclare, has a displacement in the neighborhood of 2000 feet. Figure 5 is a simplified cross section of this graben as it would look at the time it was formed and before erosion. Figure 6 on the same page shows how it looks at the present time.

In fault terminology this type of escarpment is called an obsequent fault line scarp because the scarp occurs on the hanging wall rather than on the foot wall. The escarpment owes its relief entirely to differential erosion rather than to movement along the faults.

0.2 25.4 Slow. Turn right.

0.4 25.8 Ozark-Mahoning Mine No. 1.

0.3 26.1 Slow. Turn left.

0.1 26.2 Ozark-Mahoning Deardorff Mine on the left.

0.3 26.5 Slow. Turn left.

0.1 26.6 View of the Cave in Rock blanket fluorspar district.

0.2 26.8 Concentrating mill of the Minerva Oil Company and Crystal Mine.

0.7 27.5 Slow, turn left to Benzon Mining property.

0.2 27.7 Stop 8. Abandoned Benzon Mining property. Caution, do not climb where there is loose rock.

These mines were sunk directly into the side of the hill where the fluorspar outcropped. This property attracted the attention of miners and prospectors early in the history of the district. The earliest important mining began in about 1900, but the chief producing years were those between 1920 and 1938.

The mineralization in this vicinity occurs in the Fredonia Limestone near its contact with the Rosiclare Sandstone. The spar occurs in beds frequently banded with sphalerite. Deposits displaying such banding are referred to as "coon-tail spar."

The fluorine-bearing solutions responsible for the mineralization in southeastern Illinois are considered to have come from some hidden igneous source at depth. We find some evidence of igneous activity in the fluorspar field in the form of basic igneous dikes, breccias of the explosive type, and a possible small granite mass. The mineral-bearing solutions ascended along the major fault planes and spread laterally when further vertical ascent was prevented by constriction or termination of the vertical fractures. The bedded deposits occur in limestones and it is believed that these deposits were formed primarily by the replacement of the limestones and partly by filling of cavities. Limestones possessing high purity, high permeability, and abundant joints and fractures were greatly favored by the mineralizing solutions.

The fluorine in the solutions combined with the calcium derived from the calcite in the limestone or with calcium present in the solutions to form the mineral fluorite (CaF_2).

The following minerals can be collected at this stop: fluorite, sphalerite, calcite, pyrite, barite, and galena.

- End of Trip -

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GEOLOGIC COLUMN - ROSICLARE AREA

Prepared by the Illinois State Geological Survey, Urbana

ERAS		PERIODS	EPOCHS	REMARKS
Cenozoic	Age of Mammals	Quaternary	Pleistocene	Recent post-glacial stage Wisconsinan loess Illinoian loess Slackwater lake deposits, loess, and slope wash (Stops 1, 2, and 4)
		Tertiary	Pliocene	Gravels
			Miocene Oligocene Eocene Paleocene	Not present in field trip area.
Mesozoic	Age of Reptiles	Cretaceous		Not present in field trip area.
		Jurassic		Not present in Illinois.
		Triassic		Not present in Illinois.
Paleozoic	Age of Amphibians and Early Plants	Permian		Not present in Illinois.
		Pennsylvanian	McLeansboro	Shale, coal, underclay, sandstone, limestone
			Kewanee	Sandstone, shale, and limestone
			McCormick	Sandstone, shale, and limestone
		Mississippian	Chester (Upper Mississippian)	Alternating sandstone, limestone, and shale formations
			Meramec	Limestone
			Osage	Limestone and shale
	Age of Fishes	Devonian		Limestone and shale
	Age of Invertebrates	Silurian		Not exposed in field trip area.
		Ordovician		Not exposed in field trip area.
		Cambrian		Not exposed in field trip area.

Proterozoic

Archeozoic

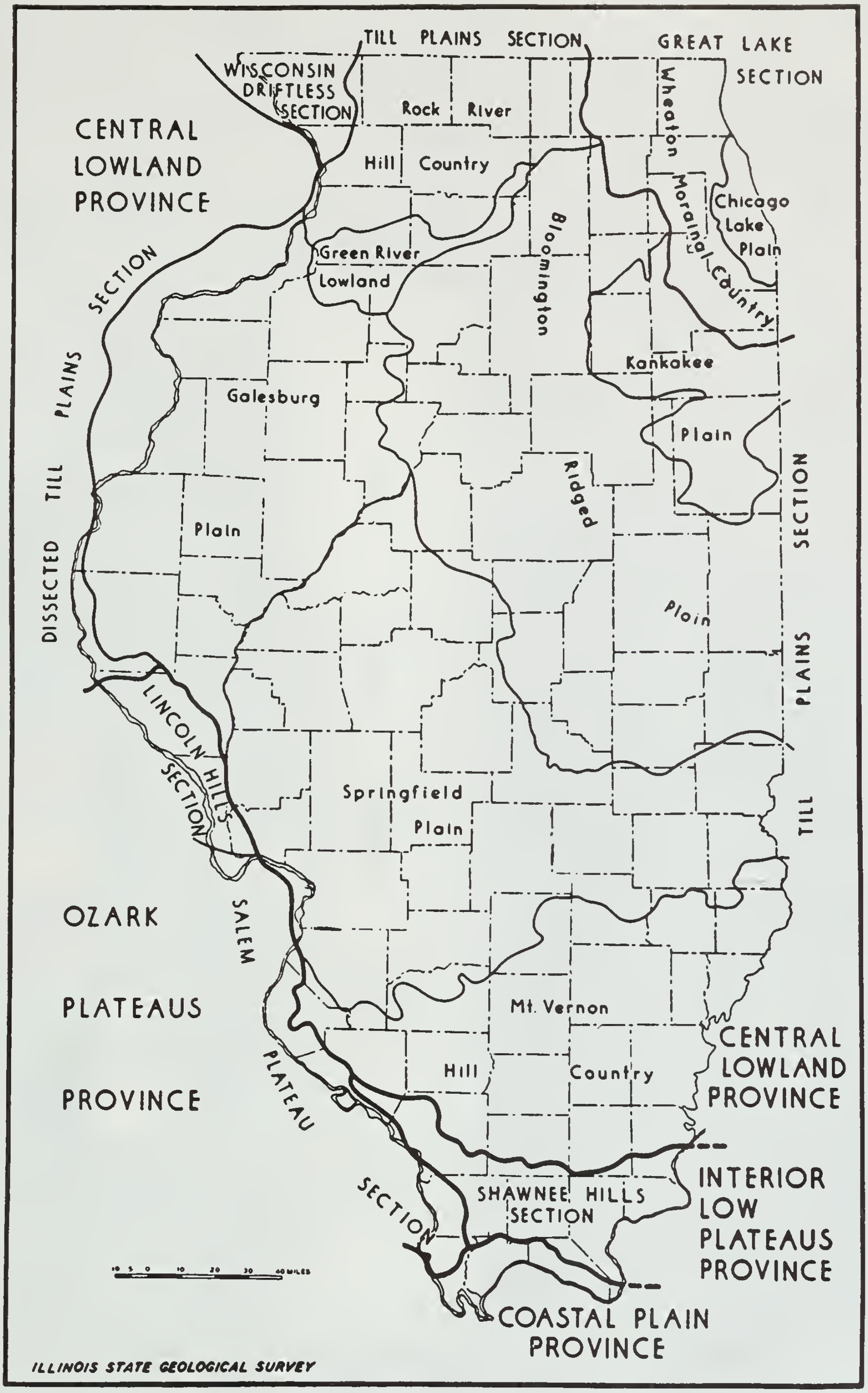
Referred to as "Pre-Cambrian"

No data available.

FORMATION IN THE ROSICLARE AREA

Pennsylvanian System
- Caseyville Group
  - Reynoldsburg Coal
  - Pounds Ss.
  - Battery Rock Coal
  - Sellers Ls.
  - Battery Rock Ss.
  - Lusk Sh.

Mississippian System
- Chester Series
  - Kinkaid Ls. and Sh.
  - Degonia Ss.
  - Clore Ls.
  - Palestine Ss.
  - Menard Ls. and Sh.
  - Waltersburg Ss.
  - Vienna Ls.
  - Tar Springs Ss. and Sh.
  - Glen Dean Ls. and Sh.
  - Hardinsburg Ss.
  - Golconda Ls. and Sh.
  - Cypress Ss.
  - Paint Creek Ss. and Sh.
  - Bethel Ss.
  - Renault Ls. and Sh.
- Valmeyer Series
  - Levias Ls.
  - Rosiclare Ss.
  - Fredonia Ls.
  - St. Louis Ls.
  - Salem Ls.
  - Warsaw Ls.
  - Keokuk Ls.
  - Burlington Ls.
- Kinderhook Series
  - Chouteau Ls.



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Illinois State Geological Survey Report of Investigations 129, "Physiographic Divisions of Illinois," by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

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